

# AIAG Metrology Interoperability

Common Data formatting



TM

**Tecnomatix**

# Meeting Agenda – Day 1

- 9:00 Introductions
  - Election of chair/co-chair and recording secretary
  - Identify schedule
  - Identify necessary help [specialists] needed for project completion
- 9:30 Review/Refine Mission Statement
- 10:00 Define approach to define data model
  - Proposed
    - Extend existing DTDs
    - Use existing DTDs to test data requirements
    - Map existing DTDs to AP219 data model

# Meeting Agenda (Day 1 cont)

- 10:30 Define Long Term goals
  - Proposed
    - Provide input to AP214 definition for Feature and Tolerance data model
    - Provide input to AP219 data requirements for reporting
- 11:00 Break
- 11:15 Review DTD data model
- 12:00 Lunch
- 1:00 Map DTD to DMIS
- 3:00 Break
- 3:15 Continue mapping DTD to DMIS
- 4:45 Review days activities
- 5:00 Conclude Day 1

# Meeting Agenda – Day 2

- 8:00 Review Day 1 activities
- 8:30 Define additional deficiencies to existing DTDs
- 10:00 Break
- 10:15 Review of AP219 data model
- 12:00 Lunch
- 1:00 Start document to define data requirements
- 3:00 Break
- 3:15 Continue document to define data requirements
- 4:00 Assign tasks, set next meeting, etc.
- 5:00 Conclude Day 2

# Mission Statement

Define and document the data requirements for dimensional inspection results and reporting.

## Deliverables

- Documented data requirements
  - AP214 updates to reflect valid ASME Y14.5
  - AP219 updates to meet needs of mission statement
- A working data model
- Documented production applications of data model

# DML – Dimensional Markup Language

- WEB Friendly
- Based on 15 year old feature/tolerance model
- Capable of detailed analysis
- Applications exist to write and read DML
  - Inspection
  - Analysis
  - Reporting
  - SPC

# DML Structure

```
xml version="1.0" encoding="UTF-8" ?>
<!-- DATE : Thr May 31 10:52:33 2001-->
<!-- UTC DATE: 2001-05-31T17:52:33Z-->
< dimensional_inspection_results version="1.04" id="RUN1">
  < results_header>
  < transform_list>
  < datum_definition_list>
  < nominal_tolerance_list>
  < feature_list>
    < analysis_modes_default>
    < analysis_dofs_default>
    < feature name="basic_hole_hole_center_lower_TPRH701" >
      < applied_tolerances>
      < cone_feature type="INNER">
        < nominal_cone_feature>
        < measured_cone_feature>
      </ cone_feature>
      < measured_tolerance_list>
      < point_list>
    </ feature>
  </ feature_list>
</ dimensional_inspection_results>
```

# DML Top Level Elements

The **results\_header** section is used to store implementation specific information like company name, location, etc. This is a required element for a DML to validate.

The **transform\_list** is for storing transformation associated to reporting the data out in different coordinate systems. One of the fundamental rules of the DTD is that all data is stored in a common coordinate system. It is the job of the reporting tool to display the information in the proper space. This is an optional element for a DML to validate.

The **datum\_definition\_list** is used to store the datum definitions used for the tolerances. In the tolerances either the datum definition or the feature ID can be used. This is an optional element for a DML to validate.

The **nominal\_tolerance\_list** is used to store the nominal information for the tolerances. The measured information is stored as part of the feature information. This is an optional element for a DML to validate.

The **feature\_list** is the most important top level element because it stores the bulk of the inspection results. It includes the nominal, measured and raw data for the feature. As well as the measured instance of any tolerance applied to it. This is a required element for a DML to validate.



# Feature\_list Element

The **analysis\_modes\_default** element is used to store the default analysis modes for all features that don't have them explicitly defined. This is an optional element for a DML to validate.

The **analysis\_dofs\_default** element is us to *store the default degree of freedom settings for all features that don't have them explicitly defined. This is an optional element for a DML to validate.*

The **feature** element stores the bulk of information and is subdivided into 5 elements, **analysis\_modes**, **applied\_tolerances**, feature specific element, **measured\_tolerance\_list** and **point\_list**.

# Feature Element

The **analysis\_modes**, **applied\_tolerances**, **measured\_tolerance\_list** and **point\_list** are optional elements. However if you have measured instances of a tolerance, the nominal tolerance must be defined in the **nominal\_tolerance\_list** element. Not all information for the tolerance is stored in the measured instance.

The **analysis\_modes** element allows a particular feature to be calculated using analysis modes that differ from the defaults. So if the defaults apply, no need to repeat the information on the feature.

The **applied\_tolerances** element makes it easier to track which tolerances are applied to a feature. A reporting application need not parse through all elements in the **measured\_tolerance\_list**. It also allows the specification of tolerances that are applied but not measured.

The **point\_list** is where the raw data is stored. Currently it assumes surface data.

# View DML Sample

[View Sample](#)

# Feature Summary

Type	DML	DMIS	AP219	
Point	X	X	X	
Line	X	X	X	
Plane	X	X	X	
Circle	X	X	X	
Ellipse	X	X		
Cylinder	X	X	X	
Sphere	X	X	X	
Cone	X	X	X	
Pattern	X	X	X	
Open slot	X		X	
Closed slot	X	X	X	
Point Surface	X	X		
Point Curve	X	X		
Constant Xsect	X			
Surface of Revolution	X		X	

[Update Chart](#)

# Constructed Feature Summary

Type	DML	DMIS	AP219
Point			
Line			
Plane			
Circle			
Cylinder			
unknown_feature_type			
<b>Construct Method</b>			
MIDDLE			
PROJECT			
INTERSECT			
TRANSLATE			
VERTEX			
PERPENDICULAR			
OFFSET_PERP_TO_1			
INTERSECT_PT_CYL			
INTERSECT_LINE_LINE			
UNKNOWN)			
PARALLEL			
OFFSET_PERP_TO_2			
INTERSECT_PT_PLANE			
PERPENDICULAR_DMIS			
TANGENT			
PERPENDICULAR_TO_2			
INTERSECT_LINE_CYL			
PARALLEL_DMIS			
TANGENT_THRU			
INTERSECT_PT_LINE			
CURVE			
BEST_FIT_DMIS			
BEST_FIT			
OFFSET			
CENTROID			

[Update Chart](#)

# Tolerance Summary

Type	DML	DMIS	AP219
diameter_limit	X		?
diameter_delta	X	X	?
radius_limit	X		?
radius_delta	X		?
length_limit	X		
length_delta	X	X	
width_limit	X		
width_delta	X	X	
angle_limit	X		
angle_delta	X	X	
distance_between_limit	X		
distance_between_delta	X	X	
angle_between_limit	X		
angle_between_delta	X	X	
straightness	X	?	
straightness_cyl_zone	X	?	
flatness	X	X	
cylindricity	X	X	
circularity	X	X	
perpendicularity_cyl_zone	X	X	
perpendicularity_pln_zone	X	X	
angularity_cyl_zone	X	X	
angularity_pln_zone	X	X	
parallel_cyl_zone	X	X	
parallel_pln_zone	X	X	
surface_profile_zone	X	X	
line_profile_zone	X	X	
position_cyl_zone	X	X	
position_pln_zone	X	X	
position_rad_zone	X	X	
position_ang_zone	X	X	
position_sph_zone	X		
position_elong_zone	X		
concentricity_zone	X	X	
symmetry_zone	X	X	
total_runout_zone	X	X	
circular_runout_zone	X	X	
unknown_tolerance_type	X		

Update Chart

# DTD Basics

- ? The content must appear once or not at all.
- \* The content can appear one or more times, or not at all.
- + The content must appear at least once and may appear more than once.
- [none]** The content must appear once.

**#IMPLIED** Not required, application will supply default

**#REQUIRED** An element that must appear in DML